WHAT IS CLAIMED IS:

Sub A17

1. An apparatus for canceling far end cross talk and intersymbol interference in a communication network, the apparatus comprising:

a decision feedback equalizer operable to determine a multidimensional steepest descent gradient to adjust matrix coefficients that are proportional to estimates of

$$\frac{\partial e_n}{\partial Q_k^{i,j}}, \text{ wherein } Q_k^{i,j} \leftarrow \left(Q_k^{i,j} - \mu \cdot (\frac{\partial e_n}{\partial Q_k^{i,j}}) \right).$$

2. The apparatus as set forth in Claim 1, wherein:

$$\frac{\partial e_n}{\partial Q_k^{i,j}} = 2 \cdot \left(Z_n^i - X_{n-p}^i \right) \cdot Y_{n-k}^j .$$

3. The apparatus as set forth in Claim 1, further comprising:

a vector data unit delay operator coupled to receive an input vector Y_n from a communication channel;

a vector error scaling operator for generating an error signal proportional to the difference between the output Z_n of the feedforward equalizer and the input X_n to the communication channel;

a first matrix multiplication operator coupled to multiply input from the vector data unit delay operator and the vector error scaling operator;

a matrix summation operator coupled to add the output from the first matrix multiplication operator to the output from a matrix tap unit delay operator, wherein the matrix tap unit delay operator receives input from the matrix summation operator; and

a second matrix multiplication operator coupled to multiply input from the matrix tap unit delay operator and the vector data unit delay operator, thereby generating .

4. The apparatus, as set forth in Claim 3, wherein:
the vector data unit delay operator passes a data vector Y_n through a series of unit delay operators to generate successive tap input data Y_n, Y_{n-1}, Y_{n-2}.

5. The apparatus, as set forth in Claim 4, wherein:
the first matrix multiplication operator receives the 1xN matrix Y_{n-k} from the unit delay operator and multiplies it with the Nx1 matrix of scaled vector error data (Z_n - X_n) from the vector error scaling operator.

6. The apparatus, as set forth in Claim 3, wherein:
the matrix summation operator receives a NxN adjustment matrix from the first matrix multiplication operator, adds the adjustment matrix to a Q_{n-k} matrix from the matrix tap unit delay operator, and outputs a corrected matrix Q_{n-k+1}.

7. The apparatus, as set forth in Claim 6, wherein:
the matrix tap unit delay operator receives the corrected matrix Q_{n-k+1} from the matrix summation operator, and introduces a one cycle delay to generate the Q_{n-k} matrix.

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